US EPA Mid-Continent Ecology Division

Research Project Summary

Classification Framework for Coastal Systems

Overview

States and Tribes in the US are currently faced with the task of developing >40,000 Total Maximum Daily Loads (TMDLs), many of these associated with lawsuits and court-ordered deadlines. In addition, the most recent guidance from EPA Office of Water requested that the States not only identify impaired water bodies, but list all of their water bodies under five categories based on assessment of impaired status, determination of cause of impairment as specific pollutants (subject to TMDL development), or other pollution sources, and evaluation of the adequacy of supporting monitoring data. Clearly tools are needed to improve the efficiency of determining the cause of impairment of ecological systems. The goal of diagnostics research under the Aquatic Stressors Framework is to provide tools to simplify diagnosis of the causes of biological impairment, in support of State and Tribe 303(d) list development.

Stage I of this project has produced the first version of a coastal classification strategy for Great Lakes and marine coastal watersheds, Great Lakes coastal riverine wetlands, and marine estuaries. A conceptual model for classifying coastal systems predicting sensitivity to nutrients, suspended sediments, toxics, and habitat alteration was developed, based on three factors: retention time, modifying factors, and system processing capacity (Fig. 1). A database has been constructed containing classification variables and exposure data for coastal estuaries, Great Lakes coastal riverine wetlands, and associated coastal watersheds. The database includes three components: 1) data for 203 estuarine areas in the conterminous US monitored through EMAP-Coastal 2000, and associated watersheds (Fig. 2); 2) data for 140 US Great Lakes coastal riverine wetlands monitored through EMAP's R-EMAP program, and associated watersheds (Fig. 3); and 3) relationships among watershed characteristics and flow regime characteristics for all USGS gaged drainage basins that are not regulated (Fig. 4). A preliminary cluster analysis discriminated among 11 different hydromorphological classes of estuarine systems. Future work will involve testing empirically- and model-based classes of coastal systems for differences in response to exposure or stressor gradients, and associated probabilities of impairment.

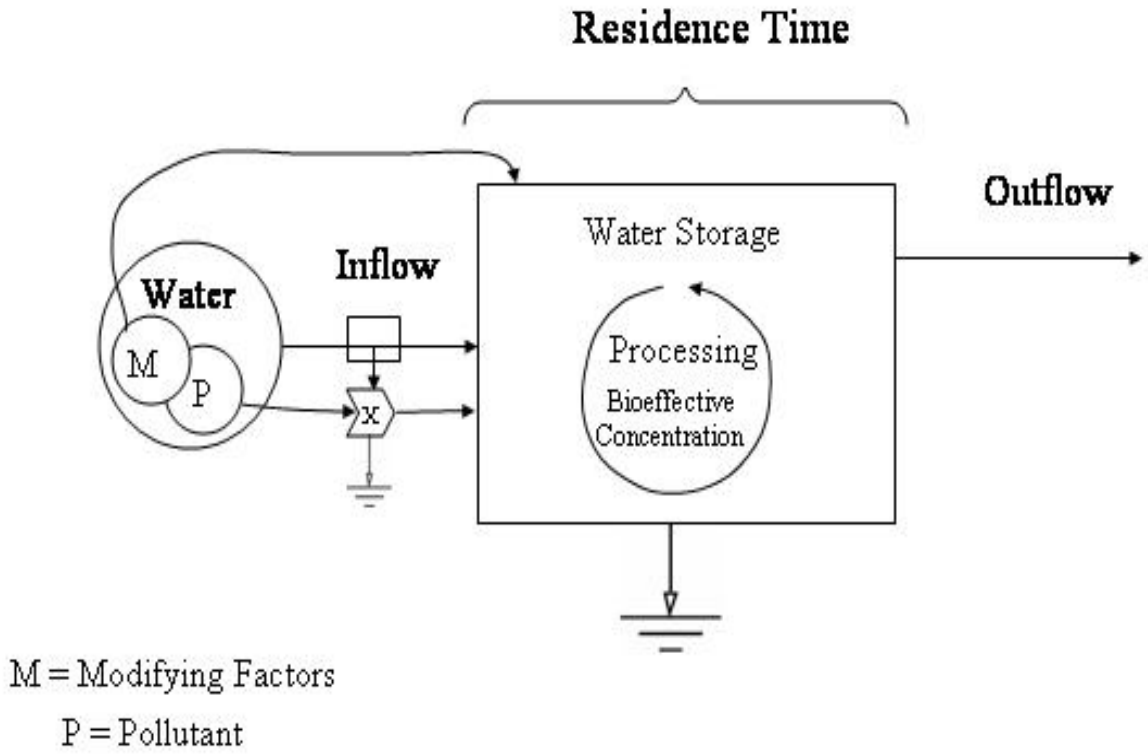

Figure 1: Conceptual Model

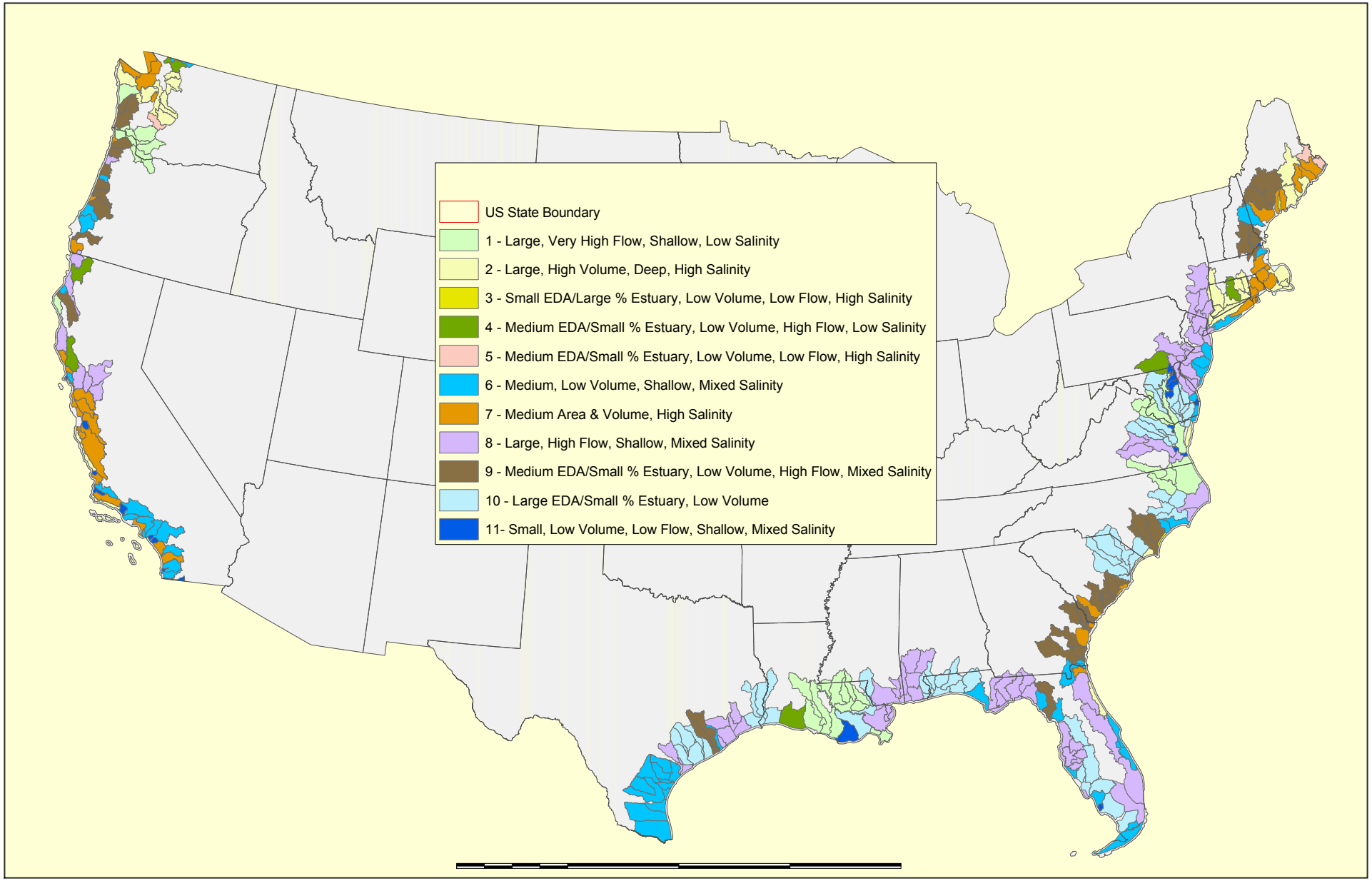

Figure 2: Data for 203 estuarine areas in the conterminous US monitored through EMAP-Coastal 2000.

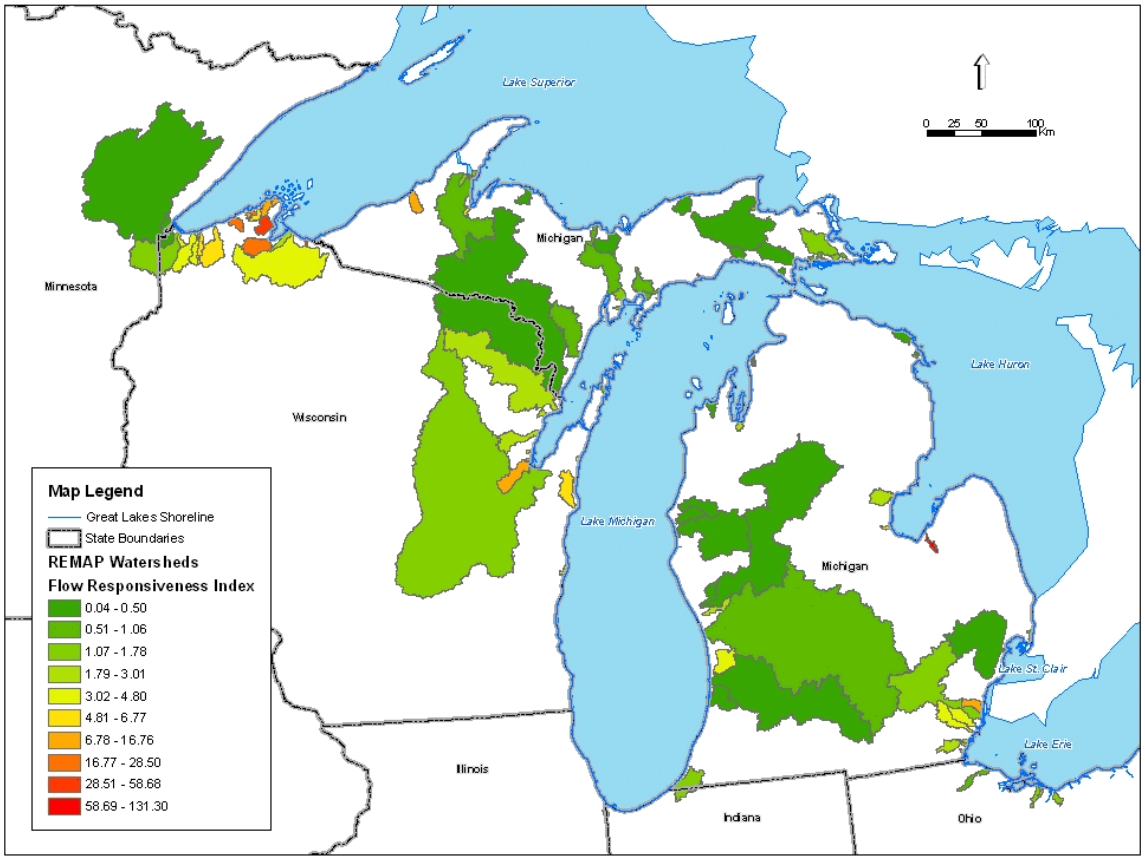

Figure 3: 140 US Great Lakes coastal riverine wetlands monitored through EMAP's R-EMAP program, and associated watersheds.

Key Products

US EPA. 2003. Classification framework for coastal systems. US EPA Report, NHEERL Gulf Ecology Division, Mid-Continent Ecology Division, and Atlantic Ecology Division, Diagnostics Committee (Burgess RM, Chancy CA, Campbell DE, Detenbeck NE, Engle VW, Hill BH, Ho KT, Kurtz JC, Norberg-King TJ, Pelletier MC, Perez KT, Smith LM, and Snarski VM).

Campbell DE, Hill BH, Detenbeck NE, Engle VW, Ho KT, Kurtz JC, Pelletier MC, Burgess RM, Perez KT, and Snarski VM. 2003. Conceptual Models and Methods for Diagnosing the Causes of Impairment to Aquatic Ecosystems. EPA Report, US EPA, National Health and Environmental Effects Research Laboratory -- Gulf Ecology Division, Mid-Continent Ecology Division, and Atlantic Ecology Division.

Detenbeck NE, Cincotta D, Denver JM, Greenlee SK, and Olsen AR. 2003. Watershed-based survey designs. Submitted to Environ Monit Assess (special issue).

Kurtz, JC, Detenbeck NE, Engle VW, Smith LM, Chancy CA, Lewis MA, Hill BH, Norberg-King TJ, Snarski VM, Pelletier MC, Campbell DE, Ho KT, Burgess RM, and Perez KT. 2003. Classifying coastal environments: Historical perspective and current necessity. To be submitted to BioScience.

For further information on this research contact:

Naomi Detenbeck (MED) / Virginia Engle (GED) / Dan Campbell (AED)
detenbeck.naomi@epa.gov / engle.virginia@epa.gov / campbell.dan@epa.gov
218-529-5204 / 850-934-9354